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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/091,106	03/05/2002	John Commander	CEDE 2036	5919
321 7590 06/26/2007 SENNIGER POWERS ONE METROPOLITAN SQUARE 16TH FLOOR ST LOUIS, MO 63102			EXAMINER WONG, EDNA	
			ART UNIT 1753	PAPER NUMBER
			NOTIFICATION DATE 06/26/2007	DELIVERY MODE ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspatents@senniger.com

**Office Action Summary**

Application No.

10/091,106

Applicant(s)

COMMANDER ET AL.

Examiner

Edna Wong

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 11 June 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-7, 17 and 65-77 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7, 17 and 65-77 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on June 11, 2007 has been entered.

This is in response to the Amendment dated June 11, 2007. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

***Response to Arguments***

**Claim Rejections - 35 USC § 103**

I. Claims 1-7, **65-71 and 74** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Creutz, deceased et al.** (US Patent No. 4,110,176) in combination with **Barstad et al.** (US Patent No. 6,444,110 B2).

The rejection of claims 1-7, 65-71 and 74 under 35 U.S.C. 103(a) as being unpatentable over Creutz, deceased et al. in combination with Barstad et al. has been withdrawn in view of the new grounds of rejection.

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II. Claims **17 and 72-73** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Creutz, deceased et al.** (US Patent No. 4,110,176) in combination with **Barstad et al.** (US Patent No. 6,444,110 B2).

The rejection of claims 17 and 72-73 under 35 U.S.C. 103(a) as being unpatentable over Creutz, deceased et al. in combination with Barstad et al. has been withdrawn in view of the new grounds of rejection.

***Response to Amendment***

***Claim Rejections - 35 USC § 112***

I. Claims **76 and 77** are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

**Claim 76**

lines 2-3, recites "a proportion between about 10 g/L and about 50 g/L".

Applicants' specification discloses "for copper or copper ions, compositions generally vary from on the order of 10 g/L to on the order of 50 g/L, and even up to saturation, depending on the acid concentration" (page 13, lines 21-24).

The Examiner has carefully considered the entire specification as originally filed, however, there is insufficient written description for "a proportion between about 10 g/L

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and about 50 g/L”.

II. Claims **70, 73 and 75-77** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 70

line 2, “the sulfur content” lacks antecedent basis. Is this the same as the overall sulfur content (from claim 1, lines 9-10)?

Claim 73

line 2, it appears that the “sulfur content” is the same as the sulfur content recited in claim 17, line 12. However, it is unclear if it is. If it is, then it is suggested that the word -- the -- be inserted before the word “sulfur”.

Claim 75

lines 1-2, recites “the electroplating bath comprises”. It is unclear how this limitation is further limiting “the electroplating bath further includes” recited in claim 65, line 2.

Claim 76

lines 1-2, recites “the electroplating bath comprises”. It is unclear how this

limitation is further limiting "the electroplating bath comprises" recited in claim 75, lines 1-2.

lines 2-3, recites "a proportion between about 10 g/L and about 50 g/L". It is unclear how this is further limiting the "proportion between about 50 g/L and saturation" recited in claim 75, lines 2-3.

The lower end of the range recited in claim 76 is outside the lower limit recited in claim 75.

#### Claim 77

lines 1-2, recites "the electroplating bath comprises". It is unclear how this limitation is further limiting "the electroplating bath comprises" recited in claim 76, lines 1-2.

lines 2-4, it is unclear what is meant by "copper sulfate in a proportion equivalent to between 59 g/L and about 75 g/L copper sulfate pentahydrate".

#### ***Claim Rejections - 35 USC § 102/103***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by

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another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

I. Claims **1-3, 5-7, 65-66, 70-71 and 75-77** are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over **Barstad et al.** (US Patent Application Publication No. 2006/0183328 A1).

Barstad teaches a method for electroplating a copper deposit (= copper has been electrolytically deposited) onto a semiconductor integrated circuit device substrate **16** with electrical interconnect features including submicron-sized features such that the surface has submicron-sized reliefs therein (= a semiconductor wafer has one or more microvias) [page 5, [0054] and [0057]], the method comprising:

(a) immersing the semiconductor integrated circuit device substrate **16** into an electroplating bath including:

(i) ionic copper (page 3, [0029]),

(ii) a suppressor (page 4, [0043] and [0044]),

(iii) an accelerator (= a brightener) [page 3, [0035]], and

(iv) an effective amount (= from about 0.05 to 0.5 mg/l) of a defect

reducing agent (= a leveling agent) to increase an overall chloride content and an

overall sulfur content of the copper deposit (*inherent*), wherein the defect reducing agent is a reaction product of benzyl chloride and hydroxyethyl polyethylenimine (see US Patent Nos. 3,770,598 and 4,555,315) [page 4, [0048]]; and

(b) electroplating the copper deposit from said bath onto the substrate to superfill the submicron-sized reliefs by rapid bottom up deposition (= bottom-fill plating) within the reliefs whereby the occurrence of protrusion defects from superfilling, surface roughness, and voiding due to uneven growth are reduced, and macro-scale planarity across the semiconductor integrated circuit device substrate is improved (page 2, [0019] and [0020]; and page 4, [0041]).

The defect reducing agent reduces high current density edge effect during the electroplating (*inherent*).

The defect reducing agent improves distribution of deposited copper over the substrate surface (*inherent*).

The defect reducing agent facilitates deposition of a thinner overall deposit to achieve a minimum thickness across the substrate than an overall deposit required to achieve such minimum thickness by electroplating without said defect reducing agent (*inherent*).

The method further comprises removing a portion of the copper deposit by chemical and mechanical action to yield a level substrate (= CMP) [page 5, [0056]], wherein an amount of copper deposit to be removed is less than an amount of copper



deposit which must be removed by chemical and mechanical action to yield a level substrate in a comparable substrate electroplated without said defect reducing agent (*inherent*).

Wherein pitting corrosion from said chemical action is less severe than pitting corrosion in the comparable substrate electroplated without said defect reducing agent (*inherent*).

The electroplating bath further includes sulfuric acid present in an amount between about 150 g/L and about 225 g/L (= at a concentration from about 10 to about 300 g/l of plating solution) [page 3, [0029]; and pages 5-6, Examples 2-3].

Wherein a source of the ionic copper is copper sulfate pentahydrate present in an amount between about 59 g/L and about 75 g/L (= at a concentration from about 10 to about 300 g/l pf plating solution) [page 3, [0029]; and pages 5-6, Examples 2-3].

The sulfur content in the copper deposit is at least about  $1.5 \times 10^{18}$  atoms/cm<sup>3</sup> (*inherent*).

Wherein sulfur content in the copper deposit is at least about  $3.0 \times 10^{18}$  atoms/cm<sup>3</sup> (*inherent*).

The electroplating bath comprises copper ion in a proportion between about 50g/L and saturation (= at a concentration from about 10 to about 300 g/l of plating solution) [page 3, [0029]; and pages 5-6, Examples 2-3].

The electroplating bath comprises copper ion in a proportion between about 10 g/L and about 50 g/L (= at a concentration from about 10 to about 300 g/l of plating

solution) [page 3, [0029]; and pages 5-6, Examples 2-3].

The electroplating bath comprises copper sulfate in a proportion equivalent to between 59 g/L and about 75 g/L copper sulfate pentahydrate (= at a concentration from about 10 to about 300 g/l of plating solution) [page 3, [0029]; and pages 5-6, Examples 2-3].

II. Claims **17 and 72-73** are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over **Barstad et al.** (US Patent Application Publication No. 2006/0183328 A1).

Barstad is applied as discussed above and incorporated herein.

Barstad also teaches an effective amount (= from about 0.05 to 0.5 mg/l) of a defect reducing agent (= a leveling agent) which (a) reduces a rate of recrystallization and grain growth in the copper deposit, thereby reducing the formation of internal voids within the copper deposit and (b) increases a chloride content and a sulfur content of the copper deposit as compared to a chloride content and a sulfur content of a copper deposit from a comparable electroplating bath not containing the defect reducing agent (*inherent*); and

which deposit subsequently undergoes said recrystallization and grain growth at said reduced rate and thereby is characterized by a reduced concentration of internal voids (*inherent*).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

I. Claims **4 and 67-69** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Barstad et al.** (US Patent Application Publication No. 2006/0183328 A1) as applied to claims 1-3, 5-7, 65-66, 70-71 and 75-77 above.

Barstad is as applied above and incorporated herein.

The method of Barstad differs from the instant invention because Barstad does not disclose the following:

a. Wherein the deposit has a deposit thickness of about 1 micron and which varies by no more than about 0.2 microns across the deposit, the deposit thickness being measured from an upper surface of the deposit to the substrate surface at its thickest point, as recited in claim 4.

Barstad teaches that the plating is preferably conducted at a current ranging from 1 to 40 ASF depending upon substrate characteristics. *Plating time may range from about 5 minutes to 1 hour or more*, depending on the difficulty of the workpiece (pages 4-5, [0053]).

*The plating time would have suggested a deposit thickness.*

It would have been obvious to one having ordinary skill in the art at the time the

invention was made to have modified the deposit described by Barstad with wherein the deposit has a deposit thickness of about 1 micron and which varies by no more than about 0.2 microns across the deposit, the deposit thickness being measured from an upper surface of the deposit to the substrate surface at its thickest point because the thickness of the deposit is well within the skill of one having ordinary skill in the art to determine dependent upon the intended use of the device (e.g., the thickness for a printed circuit board vs. the thickness for a semiconductor wafer), particularly to the environment to which the device will encounter, which would be most suited for the application of the device, absent evidence to the contrary.

As to the deposit thickness being measured from an upper surface of the deposit to the substrate surface at its thickest point, if the deposit thickness varies by no more than about 0.2 microns across the deposit, then measuring the deposit thickness at its thickest point would have revealed this, and that any other point beyond this would have been outside this range.

b. Wherein the electroplating bath comprises 1.0 mL/L of said defect reducing agent, as recited in claim 67.

c. Wherein the electroplating bath comprises 2.0 mL/L of said defect reducing agent, as recited in claim 68.

d. Wherein the electroplating bath comprises 5.0 mL/L of said defect reducing agent, as recited in claim 69.

Barstad teaches that typical concentrations of leveling agents range from about 0.05 to 0.5 mg/l of plating solution (page 4, [0049]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the concentration of the defect reducing agent described by Barstad with wherein the electroplating bath comprises 1.0 mL/L, 2.0 mL/L or 5.0 mL/L of said defect reducing agent because the concentration of the defect reducing agent is a result-effective variable and one skilled in the art has the skill to calculate the concentration of the defect reducing agent that would have determined the success of the desired reaction to occur, e.g., forming a leveled copper deposit (MPEP § 2141.03 and § 2144.05(II)(B)).

The Applicant has a different reason for, or advantage resulting from doing what the prior art relied upon has suggested, it is noted that it is well settled that this is not demonstrative of nonobviousness. *In re Kronig* 190 USPQ 425, 428 (CCPA 1976); *In re Linter* 173 USPQ 560 (CCPA 1972); the prior art motivation or advantage may be different than that of Applicants while still supporting a conclusion of obviousness. *In re Wiseman* 201 USPQ 658 (CCPA 1979); *Ex parte Obiaya* 227 USPQ 58 (Bd. of App. 1985) and MPEP § 2144.

II. Claim 74 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Barstad et al.** (US Patent Application Publication No. 2006/0183328 A1) as applied to claims 1-3, 5-7, 65-66, 70-71 and 75-77 above, and further in view of **Pedersen et al.** (US Patent

No. 6,673,216 B2).

Barstad is as applied above and incorporated herein.

The method of Barstad differs from the instant invention because Barstad does not disclose wherein the semiconductor integrated circuit device substrate is a silicon wafer, as recited in claim 74.

Barstad teaches plating integrated circuit devices, such as formed semiconductor devices and the like (page 5, [0054]).

Like Barstad, Pedersen teaches electrochemical processing a microelectronic workpiece. Pedersen teaches that semiconductor integrated circuits and other microelectronic devices typically include a substrate or workpiece, such as a silicon wafer, and one or more metal layers disposed on the workpiece (col. 1, lines 25-28).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the semiconductor integrated circuit device substrate described by Barstad with wherein the semiconductor integrated circuit device substrate is a silicon wafer because semiconductor integrated circuits and other microelectronic devices typically include a substrate or workpiece, such as a silicon wafer, and one or more metal layers disposed on the workpiece as taught by Pedersen (col. 1, lines 25-28).

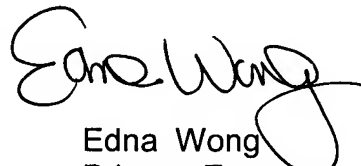
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Edna Wong whose telephone number is (571) 272-

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1349. The examiner can normally be reached on Mon-Fri 7:30 am to 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

  
Edna Wong  
Primary Examiner  
Art Unit 1753

EW  
June 19, 2007